

**REMARKS**

Claims 1, 3-5 and 8-19 are currently pending. Support for the amendment to claim 1 may be found in the specification as originally filed, for example, in original claim 2 and paragraph [0018].

Support for the new claims may be found in the specification as originally filed, for example:

Claim 11	Paragraph [0010];
Claim 12	Paragraph [0010];
Claim 13	Paragraphs [0010] and [0022];
Claim 14	Paragraphs [0011] and [0021];
Claim 15	Paragraphs [0012] and [0016];
Claim 16	Paragraphs [0012];
Claim 17	Paragraph [0012];
Claim 18	Paragraph [0031]; and
Claim 10	Paragraph [0018].

**I. The Rejection Under 35 U.S.C. §112**

Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as allegedly being indefinite.

The Examiner states that the phrase "... a range of more than 300 to 600 ..." is not clear and questions whether the value in the range of 600-900 (*sic.*) or is it more than 600 (*sic.*).

The phrase "a range of more than 300 to 600°C" is clear and definite and means  $300^{\circ}\text{C} < T \leq 600^{\circ}\text{C}$ . However, to further prosecution, in amending claim 1 to include the subject

matter of claim 2, claim 1 is amended to recite "a temperature in a range between more than 300 °C and 600 °C". For consistency, Applicants' specification has also been amended (paragraph numbered [0007] on page 4).

For the above reasons, it is respectfully submitted that Applicants' claims are clear and definite and it is requested that the rejection under 35 U.S.C. §112 be reconsidered and withdrawn.

If deemed preferable by the Examiner, Applicants offer to amend claim 2 to recite the formula  $300\text{ }^{\circ}\text{C} < T \leq 600\text{ }^{\circ}\text{C}$ .

## **II. The Double Patenting Rejection**

Claims 1, 3, 6 and 7 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as allegedly being unpatentable over claims 1, 6 and 7 of copending Application No. 10/735,824 in view of US Patent 5,273,729 (Howard et al) or in view of Applicant's admissions.

Independent claim 1 has been amended to include the subject matter of claim 2, which was not included in the obviousness-type double patenting rejection. For at least that reason, it is respectfully submitted that the subject matter of the pending claims is not obvious from the claims of copending Application No. 10/735,824 and it is requested that the obviousness-type double patenting rejection be reconsidered and withdrawn.

Applicants respectfully traverse the Examiner's statement of Applicants' admission. Applicants' specification discusses using solvents as disclosed in U.S. Patent 5,273,729 and US2003/0041732. Any "admission" is of the same scope as the prior art discussed.

### **III. Summary of the Present Invention**

Prior to addressing the Examiner's specific rejections, Applicants submit the following brief summary of some of the embodiments recited in claim 1 of the present invention. The summary is provided to the Examiner for the purposes of assisting the Examiner in understanding the claimed invention and the differences between the claimed invention and the cited art.

One embodiment of the present invention is that a temperature-regulating unit is provided between the reactor and the filtering unit. The temperature-regulating unit includes a piping passage made of a heat-resistant metallic material and a water-cooling pipe extending around the exterior of the piping passage, and the piping passage allows the gas flow discharged from the exhaust port of the reactor to enter the piping passage in a direction tangential to the piping passage and to flow in a swirl inside the piping passage (Point A). Such a structure allows the gas flow containing soot to flow in a swirl in the piping passage, whereby interior surface of the piping passage is polished by soot and total heat transfer coefficient becomes low, which results in efficient cooling of the gas flow. Accordingly, a shorter piping passage can be used. Since the interior surface of the piping passage is constantly polished, conditions of the piping passage become uniform and cooling conditions of the gas flow are stabilized, maintaining finer temperature control of the gas flow over an extended time.

Furthermore, the gas flow passing through the filtering unit can be easily controlled to a temperature of more than 300°C but not more than 600°C (Point B). When the gas flow passing through the filtering unit is controlled to a temperature of more than 300°C but not more than

600°C, soot and fullerenes contained in the exhaust gas discharged from the reactor turn into a solid state and can be recovered by the filtering unit. However, PAHs (polycyclic aromatic hydrocarbons) are maintained in a gas state and passes through the filtering unit. Therefore, fullerenes and soot excluding PAHs can be recovered by the filtering unit.

**IV. The Rejection Under 35 U.S.C. §102(e) Based on Kronholm et al**

Claims 1, 2 and 4 are rejected under 35 U.S.C. 102(e) as allegedly being anticipated by Kronholm et al (2004/0057896).

Kronholm et al discloses: (1) generating a gas stream comprising suspended soot particles and gaseous fullerenes, and separating the suspended soot particles by a gas/solid separator while maintaining the fullerenes in a gas state; (2) separating fullerenes from condensable gases by a collector; (3) in addition to soot, collecting condensable impurities, e.g., PAHs, at the filter by reacting the condensable impurities with soot or by condensing the condensable impurities onto soot particle surfaces; and (4) employing a packed bed or metal mesh filter having a mean effective pore size in the range of about 1 gm to about 50 gm as a filter of the collector.

However, Kronholm et al does not teach or disclose Point B of the present invention, i.e., by utilizing the fact that solidification temperature of PAHs is lower than that of fullerenes, regulating the temperature of the gas stream (exhaust gas) discharged from the reactor in a range between more than 300°C and 600°C, and maintaining PAHs in a gas state in order to recover soot and fullerenes from the gas stream discharged from the reactor by the filtering unit.

Furthermore, Kronholm et al does not teach or disclose provision of the temperature-regulating unit between the reactor and the filtering unit, the temperature-regulating unit

including the piping passage made of a heat-resistant metallic material and the water-cooling pipe extending around the exterior of the piping passage, the piping passage allowing the gas flow discharged from an exhaust port of the reactor to enter the piping passage in a direction tangential to the piping passage and to flow in a swirl inside the piping passage (Point A).

For the above reasons, it is respectfully submitted that the subject matter of the pending claims is not anticipated by or obvious from the disclosures of Kronholm et al and it is requested that the anticipation rejection be reconsidered and withdrawn.

**V. The Rejection Under 35 U.S.C. §103 Based on Yoshikawa in view of Howard et al**

Claims 1, 3, and 5-7 are rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Yoshikawa et al (journal article) in view of Howard et al (U.S. Patent 5,273,729).

Independent claim 1 has been amended to include the subject matter of claim 2, which was not included in the instant obviousness rejection.

Further, Yoshikawa et al discloses that toluene is supplied to a burner disposed in a low-pressure container and is burned, and then generated soot is recovered by a filter made of a sintered metal. Moreover, analysis of fullerenes, low molecular weight PAHs, and high molecular weight PAHs is conducted using the collected samples. Yoshikawa et al, however, does not disclose the embodiments of the present invention as claimed, i.e., the Points A and B.

Applicants also respectfully traverse the Examiner's apparent taking of "official notice" concerning Applicants' claimed filtration flow capacity and reactor configuration. See MPEP 2144.03.

For the above reasons, it is respectfully submitted that the subject matter of claims 1, 3 and 5 is neither taught by nor made obvious from the disclosures of Yoshikawa et al and Howard et al and it is requested that the rejection under 35 U.S.C. §103(a) be reconsidered and withdrawn.

**VI. The Rejection Under 35 U.S.C. §103 Based on Alford**

Claims 1, 3, and 5-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alford et al (2003/0041732).

Applicants respectfully submit that the present invention is not anticipated by or obvious over the disclosures of Alford et al and request that the Examiner reconsider and withdraw this rejection in view of the following remarks.

Applicants note that in the examples of Applicants' specification, some of the devices used to make the apparatus were formed using devices purchased from the U.S. company to which Mr. Alford belongs.

Alford et al does not disclose Point A of the present invention, i.e., "a temperature-regulating unit is provided between the reactor and the filtering unit, the temperature-regulating unit including a piping passage made of a heat-resistant metallic material and a water-cooling pipe extended around the exterior of the piping passage, the piping passage allowing the gas flow discharged from an exhaust port of the reactor to enter the piping passage in a direction tangential to the piping passage and to flow in a swirl inside the piping passage."

Furthermore, Alford et al does not disclose "the gas stream containing soot, fullerenes and polycyclic aromatic compounds is cooled to a temperature between more than 300°C and

600°C so that polycyclic aromatic compounds maintained in a gas state pass through the filtering unit, in which fullerenes and soot are recovered."

For the above reasons, it is respectfully submitted that the subject matter of claims 1, 3, 5 and 8-10 is neither taught by nor made obvious from the disclosures of Alford et al and it is requested that the rejection under 35 U.S.C. §103(a) be reconsidered and withdrawn.

**VII. The Rejection Under 35 U.S.C. §103 Based on Alford in view of Kronholm et al**

Claims 2 and 4 are rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Alford et al further in view of Kronholm et al.

Applicants respectfully submit that the present invention is not obvious over the disclosures of Alford et al further in view of Kronholm et al and request that the Examiner reconsider and withdraw this rejection in view of the following remarks.

As mentioned above, Kronholm et al discloses recovering soot by maintaining fullerenes in a gas state followed by collecting fullerenes using a collector. However, Kronholm et al does not teach that fullerenes and soot can be recovered with extremely small amounts of PAHs by taking advantage the fact that PAHs remain in a gas state at a temperature not less than 300°C and fullerenes remain in a solid state at a temperature of 600°C or less. Furthermore, the temperature-regulating unit having the feature of Point A for appropriately controlling the temperature of the gas fed to the filtering unit is not taught by Kronholm et al. Furthermore, Alford et al does not teach or disclose the embodiments of the present invention, i.e., Points A and B. The disclosures of Kronholm et al do not overcome the deficiencies in Alford et al.

Therefore, even if the cited references are combined, it is respectfully submitted that the present invention would not have been selected and would not have been obvious to one of ordinary skill in the art.

For the above reasons, it is respectfully submitted that the subject matter of the pending claims is neither taught by nor made obvious from the disclosures of Alford et al further in view of Kronholm et al and it is requested that the rejection under 35 U.S.C. §103(a) be reconsidered and withdrawn.

**VIII. The Rejection Under 35 U.S.C. §103 Based on Alford in view of Howard et al**

Claim 3 is rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Alford et al further in view of Howard et al.

Applicants respectfully submit that the present invention is not obvious over the disclosures of Alford et al further in view of Howard et al and request that the Examiner reconsider and withdraw this rejection in view of the following remarks.

Howard et al teaches separating fullerenes from the mixture of fullerenes and soot by a solvent. However, the existence of PAHs is not clear from Howard et al. In the present invention, fullerenes and soot recovered by the filtering unit contain substantially no PAHs; thus, the contents are different. Alford et al discloses a filtering unit, but does not disclose controlling the temperature of the gas stream entering the filtering unit in a range between more than 300°C and 600°C, or providing the temperature-regulating unit between the reactor and the filtering unit. The disclosures of Howard et al do not overcome the deficiencies in Alford et al.



Therefore, even if the cited references are combined, it is respectfully submitted that the present invention would not have been selected and would not have been obvious to one of ordinary skill in the art.

For the above reasons, it is respectfully submitted that the subject matter of the claim 3 is neither taught by nor made obvious from the disclosures of Alford et al further in view of Howard et al and it is requested that the rejection under 35 U.S.C. §103(a) be reconsidered and withdrawn.

**IX. The Rejection Under 35 U.S.C. §103 Based on Alford in view of Mueller et al**

Claim 4 is rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Alford et al further in view of Mueller et al (5,458,742).

Applicants respectfully submit that the present invention is not obvious over the disclosures of Alford et al further in view of Mueller et al and request that the Examiner reconsider and withdraw this rejection in view of the following remarks.

Mueller et al uses microwave heating to separate fullerenes. However, the fullerenes obtained by Mueller et al are generated by an arc method. Accordingly, unlike fullerenes produced by a combustion method, fullerenes obtained by Mueller et al do not contain PAHs. Therefore, Mueller et al does not disclose introducing the gas flow containing soot generated at the reactor after cooling the gas flow to a range between more than 300°C and 600°C by the temperature-regulating unit using a swirling flow. Furthermore, Mueller et al does not teach that PAHs are not trapped by the filtering unit. Therefore, even if the cited references are combined,

it is respectfully submitted that the present invention would not have been selected and would not have been obvious to one of ordinary skill in the art.

For the above reasons, it is respectfully submitted that the subject matter of the claim 4 is neither taught by nor made obvious from the disclosures of Alford et al further in view of Mueller et al and it is requested that the rejection under 35 U.S.C. §103(a) be reconsidered and withdrawn.

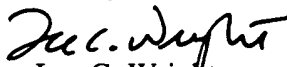
**X. Conclusion**

In view of the above, Applicants respectfully submit that their claimed invention is allowable and ask that the rejection under 35 U.S.C. §112 and the rejections under 35 U.S.C. §102 and §103 be reconsidered and withdrawn. Applicants respectfully submit that this case is in condition for allowance and allowance is respectfully solicited.

If any points remain at issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the local exchange number listed below.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,  
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